Spatial Pattern of Rural Settlements Spacing in Jhargram District, West Bengal: A Comparative Study

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Abstract: Most of the area (about 99.25%) and population (about 94.07%) of the Jhargram district belongs to rural settlements. Therefore the development of this district needs to know about rural settlements, especially the spacing of settlements. The main focus of this study is to determine the spacing between the rural settlements at the C.D block level in the Jhargram district and to highlight their spatial pattern. And also, to compare the average rural settlements spacing of the Jhargram district with other districts of West Bengal. This study has also revealed some other important settlement characteristics such as rural population density, the average population per village, the average area per village, etc. The regional socio-economic developmental issue such as associated with the provision of social, economic, and other services are determined in the above rural settlement characteristics especially settlements spacing. The infrastructural and installation arrangements required for the socio-economic development of the region are cheaper, easier, and more efficient in the case of closely packed settlements. This study has found that the rural settlement of the Jhargram is the most compact type in West Bengal after Paschim Medinipur, so it is possible to adopt an appropriate development plan and implement it easily in this backward district.

Keywords: **Jhargram, Spacing, Inter-Settlements Distance, Distance, Rural Density**

Introduction

Distance has a considerable significance in rural settlement geography. In particular, the spacing or distance (between settlements), such as population size, is one of the main foundations of rural settlement classification. J.W. Watson successfully established geography as discipline in distance. Mukherji (1975, p. 252) noted in support of Watson's statement—"that distance is implied inherently in all the phenomena of distribution, dispersion, and pattern is very well realised in all geographical studies". Spacing of rural settlements has a significant place in theoretical consideration of distribution (Singh R. P., 1975, p. 274). Singh Rana P.B. (1975, p. 274) defined the spacing as "the locational arrangement of villages with respect to one another". Das Gupta & Misra (1976) in their paper 'An Analytical Approach to the Methodology of Mapping Rural Settlements in India' mentioned rural settlements spacing:

"As regards the spacing of rural settlements two factors can be taken into account: (i) the density, i.e., number of settlements per unit area, and (ii) the distance apart of settlements. Both the aspects are equally important to specify the distributional pattern of settlements in their densities and variations of inter-distances". (p. 118)

Ahmad, E (1952) applied spacing of dwellings for "Rural Settlement Types in the Uttar Pradesh". Ahmad uses the term "types" in the classification of rural settlements in the sense that—"the characteristic groupings of rural dwellings in that well-defined parcel of the ground which is known as mauza" (Singh R. P., 1975, p. 281). Mukherji, A.B. (1975) used the regional pattern of spacing between rural settlements in Rajasthan. The formula used, by Mukherji (1975), for the computation of spacing of rural settlements in a tahsil is as follows:

$$S = \sqrt[2x]{\overline{\frac{A}{N \times \pi}}}$$

Where A is rural area in square miles, and N is the number of inhabited villages.

Singh, R.B. (1975, p. 30; 1975, pp. 228-229) used the area occupied by a hamlet and the inter-hamlet distance to determine the degree of dispersion. Singh, Singh, & Singh (1976, p. 141) used inter-settlement distance for determine the spacing pattern of rural settlements in middle Ganga valley.

Location and Geographical nature of Study Area

Jhargram district is a new district (formed 4th April 2017) in the state of West Bengal of Eastern India, and the district consists eight community development blocks (C.D blocks) namely as Binpur I, Binpur II, Jhargram, Jamboni, Sankrail, Gopiballavpur I, Gopiballavpur II, and Nayagram. The latitudinal and longitudinal expansion of the district is $22^0 47'$ N in the north to $21^0 51'$ N in the south and $86^0 33'$ E in the east to $87^0 15'$ E in the west. The district covers an area of 3042.0 Km^2. Jhargram district is situated between Kangsabati River in the north and Subarnarekha River in the south. The height of the land in the western part of the district is little more than about 300 metres, and which is the part of the chotanagpur plateau. The average annual temperature of the district is $26^0 C$, and average high and low temperature is $30^0 C$ and $22^0 C$, respectively. The annual rainfall is 100.7 cm, and most of the rainfall occurs in July to August by the south-west monsoon. The western part of the district is composed of barren laterite soil, and southern areas belonging to Nayagram, Gopiballavpur I & II blocks are composed of fertile alluvial soil. The major part of the district covers about 594.97 Km^2 of areas under dense or degraded forests, including Jhargram, Binpur I & II, and Jamboni.

It has been early mentioned that most population[1] of the district belongs to the rural. So it may be called a rural district.

Methodology

Various quantitative methods have been devised to depict the distributional pattern of human settlements. The theoretical basis for converting settlement density into spacing was suggested by Robinson and Barnes (1940). Their formula based on the concept of uniform distribution formerly devised by Christaller (Singh, Singh, & Singh, 1976, p. 141). Mather (1944) later corrected this and quoted the correct formula for determining the spacing which is Hd = $1.0746\sqrt{A/N}$, where 'A' is the area of the unit, and 'N' is the number of settlements. Here Mather's method has been used to determine the spacing of rural settlements in Jhargram district and various districts of West Bengal. Rural population density has been determined by using the following formula:

$$(\text{Rural Pop. Density}) = \frac{\text{Rural Population}}{\text{Rural Area in sq.km}}$$

Here, only mauzas population (excluding Census town) in the C.D Block was taken as rural population; and both inhabited and uninhabited mauzas areas were taken as rural areas. The average population per village has been determined by using the following formula:

$$(\text{APPV}) = \frac{\text{Rural Population}}{\text{No. of inhabited Mauza}}$$

Here is the Average Population per village (APPV). The average area per village (AAPV) is determined by using the following formula:

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[1] According to the 2011 census, Shilda (census town) and Jhargram Municipality (statutory town) are the two urban settlements in the present Jhargram district; with an area of 1.38 Km^2 and 21.40 Km^2 and population of 5724 and 61712, respectively.

$$(AAPV) = \frac{\text{Total Rural Area in sq.km}}{\text{No. of inhabited Mauza}}$$

The interdependence between different characteristics of the rural settlement such as settlement spacing, the density of rural population, the average population per village, etc. have been shown by the regression line and pearson product movement correlation coefficient.

The required data has been taken from district census handbooks of A and B part of 2011 (Census of India). The spatial pattern of the spacing, rural population density, and average population per village has been classified and shown on the map by the equal counts (quantile) module of classification of the Qgis (3.16 version Hannover) software.

Discussion

The spacing of rural settlements in the Jhargram district, based on the C.D block level, is between 0.98—1.40 km. The average spacing of the Jhargram district is 1.18 km. The spatial pattern of spacing as emerged
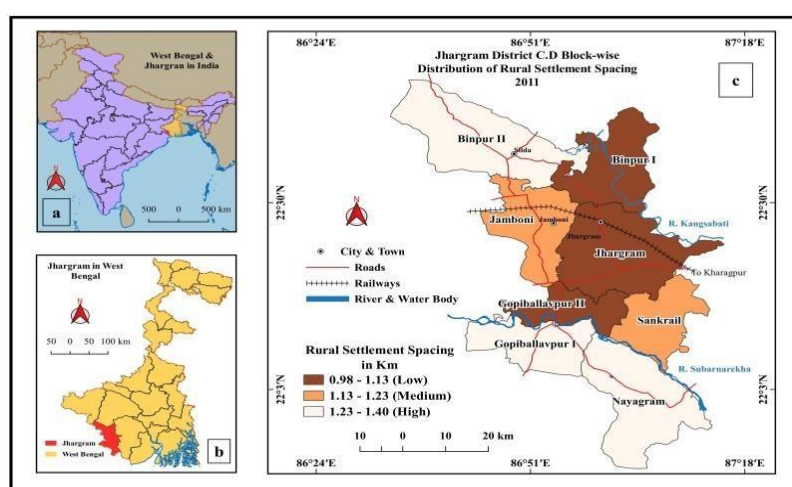

Figure 1 spatial pattern of rural settlement spacing with location map

have been categorized (by quantile module of Qgis 3.16 version Hannover software) into three types: (a) low spacing (less than 1.13 km), (b) medium spacing (1.13—1.23 km), and (c) high spacing (more than 1.23 km), respectively. Out of eight C.D blocks three blocks, such as Binpur I (0.98 km), Jhargram (1.10 km), and Gopiballavpur II (1.13 km), have low rural settlement spacing (0.98—1.13 km). These blocks are situated between Kangsabati and Subarnarekha rivers. This category has about 43.41% of the (highest) rural settlements of the district, and about 35.27% of the rural area of the district is included in this category. Except for Jhargram (330 persons/km^2), other two C.D blocks like Binpur I (437 persons/km^2) and Gopiballavpur II (546 persons/km^2) have a higher rural population density. Except for Gopiballavpur II, the other two C.D blocks like Binpur I and Jhargram have a lower average population/village (Figure 2–a). Jamboni (1.14 km) and Sankrail (1.14 km) C.D blocks are included in the medium spacing, where spacing rural settlement is 1.13—1.23 km. Medium spacing of settlement are seen in the vicinity of low spacing (Figure 1–c). About 19.70% of the rural area of the district and about 21.01% of the rural settlement of the district is included in this category. High rural settlement spacing is seen in Binpur II (1.29 km) C.D block in the north of the district and Gopiballavpur I (1.27 km) and Nayagram (1.40 km) C.D blocks in the south of the district. Nayagram have the highest settlements spacing in the district. The spacing of settlement here is 1.23—1.40 km. In most parts of the district, about 45.02% of the rural areas, and about 35.58% of the rural settlement are included in this category. Except for Binpur II (396 persons/village), the other two blocks like Gopiballavpur I (544 persons/village) and Nayagram (484 persons/village) have a higher average population/village.

Table 1 Jhargram District C.D Block Wise Area, Population, Spacing, Rural Density data of 2011

CD Block	(R) Area in Km^2	Rural Population	Inhabited Mauza	Spacing in Km	Avg. Pop/Vill	Rural Pop Density Persons/Km^2	Avg. Area in Village (Km^2)
Binpur I	357.62	156153	427	0.98	366	437	0.84
Binpur II	582.13	158798	401	1.29	396	273	1.45
Gopiballavpur I	275.83	108254	199	1.27	544	392	1.39
Gopiballavpur II	192.17	104996	175	1.13	600	546	1.10
Jamboni	318.13	113197	281	1.14	403	356	1.13
Jhargram	515.12	170097	489	1.10	348	330	1.05
Nayagram	501.44	142199	294	1.40	484	284	1.71
Sankrail	276.80	115418	247	1.14	467	417	1.12
Total	3019.24	1069112	2513	1.18	425	354	1.20

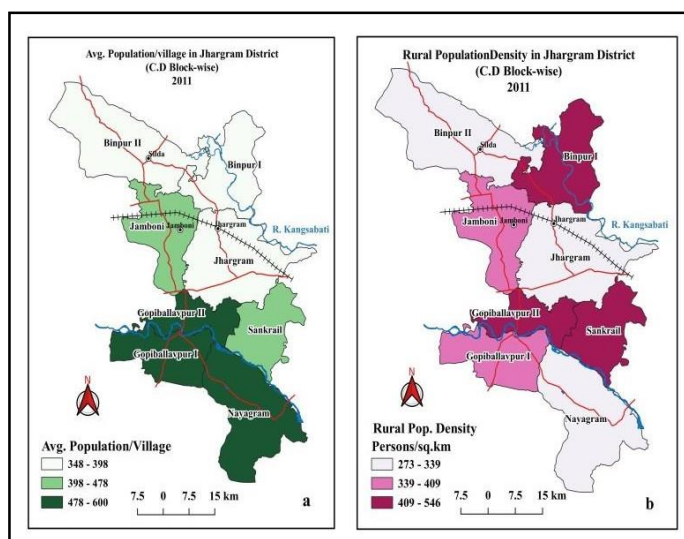Source: Computed by the Author from District Census Handbook of Paschim Medinipur 2011

Figure 2 rural settlement spacing, average population per village and rural population density in Jhargram on 2011
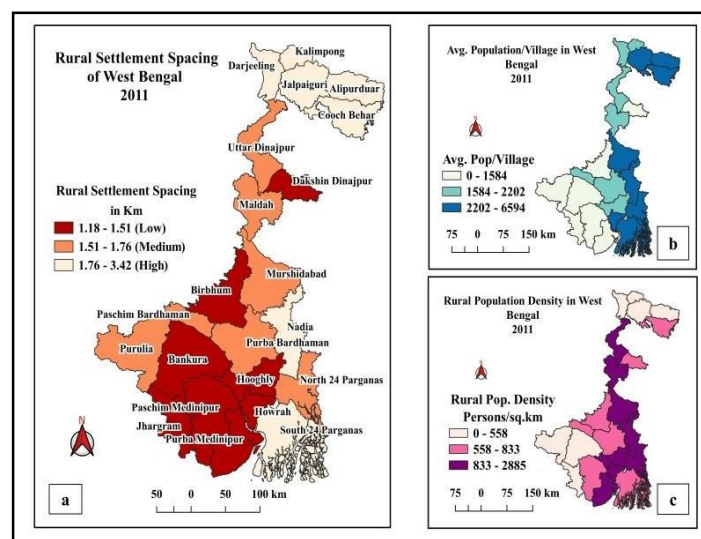

Figure 3 rural settlement spacing, average population per village and rural population density in West Bengal on 2011

Comparison with other districts of West Bengal

The spatial distribution of the spacing of rural settlements in West Bengal is very diverse in character. The spacing of settlements medium to high in all the districts of North Bengal[2], the only exception is Dakshin Dinajpur. On the other hand, except for Nadia and South 24 Parganas in South Bengal, all other districts have medium to low settlements spacing (Table 2).

Paschim Medinipur district in West Bengal has the lowest rural settlements spacing (1.176 km), followed by the Jhargram district, which has a rural settlements spacing of 1.178 km. Except for the Purulia district, lower settlements spacing is seen in the surrounding district of the Jhargram district, with the rural settlements spacing from 1.18 km—1.48 km, such as Paschim Medinipur, Purba Medinipur, Bankura, Hooghly, Howrah, and Birbhum district (Table 2). The Jhargram has the lowest average village population (425 persons/village) compared to other districts. In most of the district of North Bengal, five districts, viz., Darjeeling, Kalimpong, Jalpaiguri, Alipurduar, and Cooch Behar districts, the spacing of rural settlements is very high at 1.76 km—3.42 km, but the average population per village is comparatively higher than other districts of the state.

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[2] The Ganga River (Ganges River) divides West Bengal into South Bengal and North Bengal. The North Bengal consists of eight C.D blocks viz., Jalpaiguri, Darjeeling, Kalimpong, Cooch Behar, Alipurduar, Uttar Dinajpur, Dakshin Dinajpur, and Maldah.

Table 2 West Bengal District-wise Area, Population, Spacing, Rural Density data of 2011

District Name	Rural Area (Km^2)	Rural Population	Inhabited Mauza	Spacing in Km	Avg. Pop/Vill	Rural Density Persons/Km^2	Avg. Area in Village (Km^2)
Alipurduar	2282.98	1183704	327	2.839	3620	518	6.98
Bankura	6791.53	3296901	3585	1.479	920	485	1.89
Birbhum	4424.56	3052956	2242	1.510	1362	690	1.97
Dakshin Dinajpur	2187.75	1439981	1582	1.264	910	658	1.38
Darjeeling	1954.15	923410	513	2.097	1800	473	3.81
Howrah	1035.92	1775885	644	1.363	2758	1714	1.61
Hooghly	2820.63	3390646	1842	1.330	1841	1202	1.53
Jalpaiguri	3576.72	1628791	391	3.250	4166	455	9.15
Jhargram	3019.24	1069112	2513	1.178	425	354	1.20
Kalimpong	1041.36	195450	103	3.417	1898	188	10.11
Cooch Behar	3318.06	2529652	1132	1.840	2235	762	2.93
Maldah	3646.91	3447185	1613	1.616	2137	945	2.26
Murshidabad	5048.06	5703115	1886	1.758	3024	1130	2.68
Nadia	3612.14	3728727	1216	1.852	3066	1032	2.97
North 24 Parganas	3470.09	10009781	1518	1.625	6594	2885	2.29
Paschim Bardhaman	821.19	530077	316	1.732	1677	645	2.60
Paschim Medinipur	6095.44	4121659	5087	1.176	810	676	1.20
Purba Bardhaman	5280.67	4109187	2102	1.703	1955	778	2.51
Purba Medinipur	4488.69	4503161	2928	1.331	1538	1003	1.53
Purulia	6111.47	2556801	2459	1.694	1040	418	2.49
South 24 Parganas	9541.28	6074188	1994	2.351	3046	637	4.78
Uttar Dinajpur	3075.26	2644906	1475	1.552	1793	860	2.08

Source: Computed by the author from all the district census handbook of A and B Part of 2011

Conclusion

Settlements spacing is an important aspect of geography, in particular rural settlement geography. Successfully implications of rural planning are almost dependent on settlements spacing or rural density.
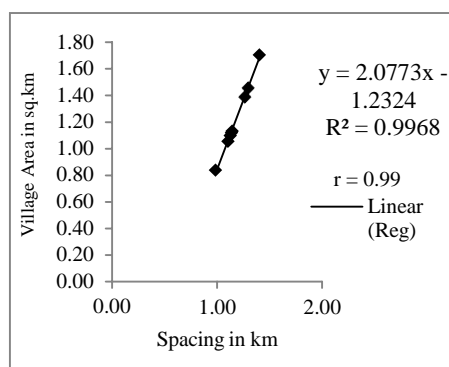

$y = 2.0773x - 1.2324$
$R^2 = 0.9968$

$r = 0.99$
—— Linear (Reg)

$y = -411.19x + 865.42$
$R^2 = 0.3634$

$r = -0.60$
—— Linear (Reg)

$y = 220.55x + 190.2$
$R^2 = 0.1061$

$r = 0.33$
—— Linear (Reg)

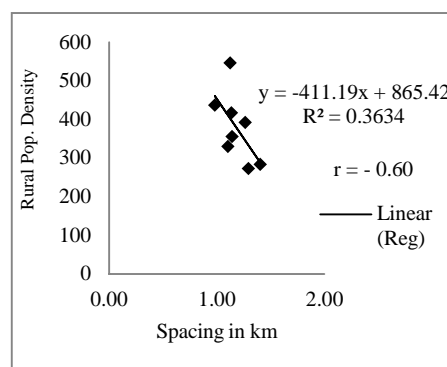**Figure 4 the correlation between spacing and village avg. area**

Figure 5 the correlation between spacing and rural pop. density
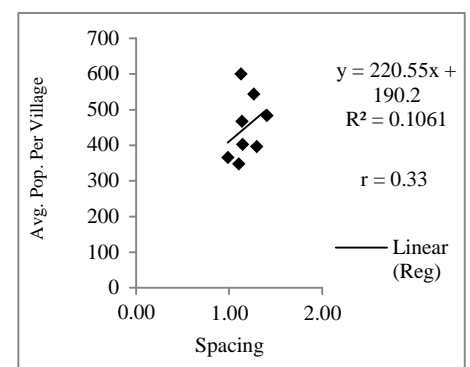
Figure 6 the correlation between spacing and avg. pop. per village

This study has found that the size (area) of the villages in the Jhargram district is small and very densely packed. Thus, there is a positive correlation (r = 0.99) between the spacing of villages and the average size (area) of the villages i.e. the average area of villages has increased with increasing spacing in settlements. There is a negative correlation (r = -0.60) between rural population density and spacing. But there is a low positive correlation (r = 0.33) between settlements spacing and average population per village. So we cannot freely say that the average village population (average population/village) has increased with the increasing spacing. Thus if the analysis of spacing in all the districts of West Bengal is analysed then it can be understood that human settlements of Jhargram district are of a compact type; and, the role of the socio-economic structure along with the natural environment of this district is evident in its creation. For the low rural settlements spacing, it is suitable to adopt an appropriate rural development plan and implement it easily.

Acknowledgement

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